

REMARKS

Applicants thank the Examiner for the thorough examination given the present application.

Status of the Claims

Claims 7-12 and 15 will be pending in the above-identified application upon entry of the present amendment. Claims 7, 11-12, and 15 have been amended. Claims 1-6 and 16-20 have been cancelled. Support for the recitations in claim 7 can be found in the Examples of the present specification. Specifically, the recitation of “a single pass” can be found, *inter alia*, in Examples 1 and 2. Claims 11-12 and 15 have been amended to provide proper antecedent basis. Thus, no new matter has been added. Based upon the above considerations, entry of the present amendment is respectfully requested.

In view of the following remarks, Applicants respectfully request that the Examiner withdraw all rejections and allow the currently pending claims.

Statement of the Substance of the Interview

Applicants would like to thank the Examiner for her time during the interview on April 28, 2009. Applicants appreciate the courtesies extended to them in this application. In compliance with MPEP 713.04, Applicants submit the following remarks.

The Interview Summary sufficiently summarizes the discussions during the interview. Although an agreement could not be reached, Applicants believe that the claims are now in condition for allowance. Should the Examiner believe that there remains any outstanding issues, Applicants respectfully request that the Examiner contact Applicants' Representative so as to expedite resolution of these outstanding issues, via an Examiner's Amendment or the like.

Claim Objections

The Examiner has objected to claims 1-6 and 16-20 for containing parentheses around “hereinafter, GPC” in claim 1. Claims 1-6 and 16-20 have been cancelled herein, which renders this objection moot.

Issues under 35 U.S.C. § 112, second paragraph

The Examiner has rejected claims 11-12 and 15 under 35 U.S.C. § 112, second paragraph, as being indefinite. Specifically, the Examiner states that the phrase “aliphatic percarboxylic acid” in claims 11-12 and 15 lack antecedent basis.

The claims have been amended to replace the phrase “aliphatic percarboxylic acid” with “peracetic acid.” Thus, Applicants respectfully submit that the amendments overcome the outstanding rejection and that the rejection be removed.

Issues under 35 U.S.C. § 103

1) The Examiner has rejected claims 1-6 and 16-20 under 35 U.S.C. § 103(a) as being unpatentable over Takai ‘618 (US 2003/0059618) in view of Kuwana et al. ‘176 (US 5,446,176). Claims 1-6 and 16-20 have been cancelled herein, which renders this rejection moot.

2) The Examiner has rejected claims 7-12 and 15 under 35 U.S.C. § 103(a) as being unpatentable over Takai ‘618 in view of Kumabe et al. ‘070 (US 6,201,070) and in further view of Kuwana et al. ‘176. Applicants respectfully traverse, and reconsideration and withdrawal of the rejection are respectfully requested.

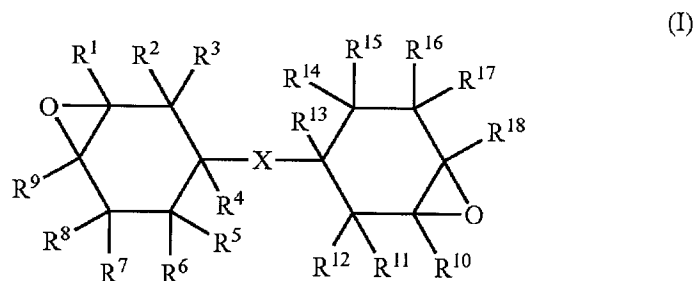
As amended, independent claim 7 recites, *inter alia*, that “the purification by distillation is carried out in a single pass at a heating temperature ranging from 180 to 350°C and at a pressure of 1 to 50 Torr.”

As the Examiner admits, Takai ‘618 does not disclose the purification by distillation conditions recited in the present claims. To overcome this deficiency, the Examiner relies on Kumabe et al. ‘070. However, Kumabe et al. ‘070 disclose multiple passes through a wiped-film evaporator, one of which occurs at 180°C and 0.1-0.15 mmHg. In stark contrast, amended claim 7 recites a higher pressure and only a single pass through a wiped-film evaporator.

During the interview, the Examiner admitted that the cited references do not explicitly disclose that purification by distillation is carried out in a single pass at a pressure of 1 to 50 Torr. However, the Examiner stated that these variables may be considered to be routine optimization without further evidence. Applicants respectfully traverse and submit that Kumabe et al. ‘070 is not properly combinable with Takai ‘618.

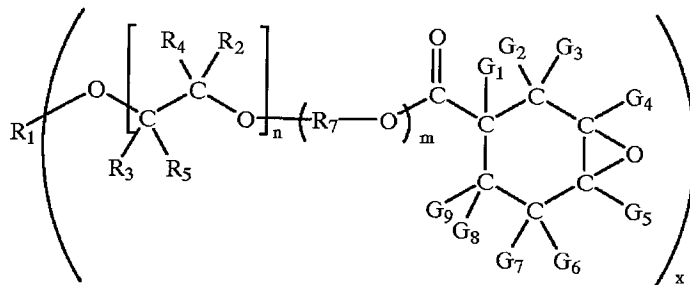
As disclosed in the present specification, the CEL-2021P and CEL-2081 have hydrolyzability due to an ester bond in the molecule. Therefore, when they are used under high temperature and humidity conditions or such a condition that a strong acid occurs, a cured product may be reduced in the physical property. Thus, there has been a demand for an epoxy compound having an alicyclic skeleton *with no ester bond in the molecule* (page 2; emphasis added).

An object of the present invention is to provide a process of efficient production of a high-purity alicyclic epoxy compound by the use of a low-toxicity solvent, in which an alicyclic olefin compound is epoxidized with an aliphatic percarboxylic acid having substantially no water followed by purification to thereby produce *the high-purity alicyclic epoxy compound without an ester bond* that is reduced in the concentration of high-molecular-weight components each having an elution time shorter than that of the alicyclic epoxy compound (I) in detection by a GPC analysis and in the concentration of impurities or reactive intermediates each having a retention time shorter than that of the alicyclic epoxy compound (I) in detection by a gas chromatography, that is improved in a color hue, and provides a cured product enhanced especially in transparency and heat resistance (page 5; emphasis added). The alicyclic epoxy compound is recited in claim 7 as the following formula (I),



wherein X is a divalent group selected from the group consisting of an oxygen atom, a sulfur atom, -SO-, -SO₂-, -CH₂-, -C(CH₃)₂-, -CBr₂-, -C(CBr₃)₂-, and -C(CF₃)₂-; and R¹ to R¹⁸ each may be identical or different from each other and are a hydrogen atom, a halogen atom, a hydrocarbon group that may contain an oxygen atom or halogen atom, or an alkoxy group that may have a substituent.

On the other hand, *the compounds taught in Kumabe et al. '070 have the ester bond* in the molecule as shown below, and the methods in Kumabe et al. '070 are disclosed for enhancing *the toughness, e.g., resistance to cracking upon flexation* (abstract).



Therefore, Kumabe et al. '070 do not relate to the present invention, and one of ordinary skill in the art would not find it obvious to combine Kumabe et al. '070 with Takai '618.

A cured product enhanced especially in transparency and heat resistance can be made from *the high-purity alicyclic epoxy compound without an ester bond in the molecule obtained by the claimed process* comprising the step of subjecting *the alicyclic epoxy compound without an ester bond in the molecule* in turn to purification by distillation with wiped film evaporator in a single pass at a heating temperature ranging from 180 to 350°C and at a pressure of 1 to 50 Torr to thereby produce *the high-purity alicyclic epoxy compound without an ester bond in the molecule* with the concentration of high-molecular-weight components having an elution time shorter than that of the alicyclic epoxy compound in detection by gel permeation chromatography analysis being 5.5% or less with respect to the sum total of all of detected peak areas in terms of the peak area ratio per elution time.

In addition, the Examiner admits that Takai '618 does not state that “the concentration of high-molecular-weight components having an elution time shorter than that of the alicyclic epoxy compound...is 5.5% or less” as recited in independent claim 7. The Examiner also admits that Takai '618 does not teach that a “color hue...is 60 or less” as recited in claim 10.

To overcome this deficiency, the Examiner asserted that it is implicit that the composition of Takai '618 would also have these properties and that Applicants have the burden to present evidence to refute this position. In response, Applicants have provided evidence found in the present specification. However, on page 10 of the outstanding Office Action, the Examiner stated, "The prior art specifically states the composition is 93.4% pure, which means there are 6.6% impurities. It is unknown why the results of this one experiment differ with the results of the one experiment of the comparative example 1 of the instant, especially since yields were the same."

In the present invention, an alicyclic epoxy compound (I) was analyzed by GPC Analysis and gas chromatography as follows (page 38, line 14 to page 40, line 10 in the present specification):

<GPC Analysis>

In pretreatment, 0.04 g of an alicyclic epoxy compound (I) is dissolved in 2 g of tetrahydrofuran (THF) and filtered with a filter having a pore size of 0.50 μ m [DISMIC13JP050AN manufactured by Toyo Roshi Kaisha, Ltd.]. The resulting THF solution of the alicyclic epoxy compound (I) is analyzed by a GPC to give the rate of a peak area for each of the components as the concentration of each of the components. The respective concentrations of components eluted earlier than the alicyclic epoxy compound (I) are summed to determine the concentration of high-molecular-weight components.

Apparatus: HLC-8220GPC [manufactured by TOSO CORPORATION]
Detector: differential refractometer (RI detector)
Precolumn: TSKGUARDCOLUMN SUPER HZ-L 4.6 mm \times 20 mm
Column: sample side TSK-GEL SUPER HZM-N 4.6 mm \times 150 mm \times 4
reference side TSK-GEL SUPER HZM-N 6.0 mm \times 150 mm \times 1
+TSK-GEL SUPER H-RC 6.0 mm \times 150 mm
Thermostat temperature: 40°C
Moving phase: THF
Flow amount of moving phase: 0.35 ml/min
Sample amount: 10 μ l
Data sampling interval: 10 min to 26 min after sample injection

<Gas chromatography>

An alicyclic epoxy compound (I) is directly analyzed by gas chromatography without pretreatment. The rate of a peak area of each of the components with respect to the sum total of all of detected peak areas is given as the concentration of each of the components.

Apparatus: GC14-B type (manufactured by Shimadzu Corporation)

Column: Thermon 3000/5% Shincarbon A 2.6 mm × 3m

Nitrogen flow: 40 ml/min

Air pressure: 60 kPa · s/cm²

Hydrogen pressure: 60 kPa · s/cm²

Thermostat temperature: retain 60°C for 2 min, then elevate up to 250°C by 10°C/min, and retain for 19 min

Injection port temperature: 250°C

Detector side temperature: 250°C

Detector: FID

RANGE: 10³

Injection amount: alicyclic epoxy compound (I) 1 μl

Data sampling interval: up to 40 min from just after sample injection

Data processor: C-R5A (manufactured by Shimadzu Corporation)

Min. Area: 100

SLOPE: 700

DRIFT: AUTO

Specifically, in Figure 5, a GPC chart of the alicyclic epoxy compounds (IA) obtained in Example 1 and Comparative Example 1 are shown. Further, in Figures 6 and 8, gas chromatograph charts of the alicyclic epoxy compounds (IA) obtained in Example 1 and Comparative Example 1 are shown, respectively.

On the other hand, **Takai '618** does not teach how the purity was determined. Therefore, it is unknown why Takai '618 states the composition is 93.4% pure.

The *concentration of high-molecular-weight components, concentration of impurities, and concentration of reactive intermediate compounds* of the present examples and comparative examples (i.e., Example 1 of Takai '618) are shown in the table below.

| | <i>Concentration of high-molecular-weight components having an elution time shorter than that of the alicyclic epoxy compound represented by the general formula (I) in detection by a gel permeation chromatography (%)</i> | <i>Concentration of impurities having a retention time shorter than that of the alicyclic epoxy compound represented by the above general formula (I) in detection by gas chromatography (%)</i> | <i>Concentration of reactive intermediate compounds (%)</i> | <i>Purification by distillation after removing low-boiling fractions</i> |
|-----------------------------|--|--|---|--|
| Ex. 1 | 5.2 | 12.1 | 2.3 | WFE at 180°C, 4 Torr |
| Comp. Ex. 1 (Takai's Ex. 1) | 12.5 | 11.9 | 2.0 | non |
| Ex. 2 | 3.7 | 7.1 | 2.8 | WFE at 180°C, 5 Torr |
| Comp. Ex. 2 | 14.7 | 7.9 | 2.7 | non |
| Ex. 3 | 3.5 | 8.7 | 2.4 | simply distilled at 180°C, 1 Torr |
| Comp. Ex. 3 | 13.2 | 5.2 | 2.2 | non |
| Ex. 4 | 2.0 | 1.2 | 0.0 | 5-stages Older Shaw at 236°C, 2Torr |
| Ex. 5 | 2.3 | 1.1 | 0.0 | WFE at 180°C, 5 Torr |
| Comp. Ex. 4 | 36.9 | 10.2 | 3.5 | non |
| Comp. Ex. 5 | 35.2 | 9.8 | 3.2 | non |

As shown above, concentrations of impurities having a retention time shorter than that of the alicyclic epoxy compound represented by the above general formula (I) of the present Example 1 and Comparative Example 1 are almost the same. Additionally, concentrations of reactive intermediate compounds of the present Example 1 and Comparative Example 1 are almost the same.

On the other hand, in the present Example 1, the *concentration of high-molecular-weight components* is **5.2%**. In contrast, the *concentration of high-molecular-weight components* is **12.5%** in Comparative Example 1. The difference between Example 1 and Comparative Example 1 is whether the post-reaction solution was distilled in a WFE-type thin film evaporator at a heating temperature of 180°C and a pressure of 4 Torr or not.

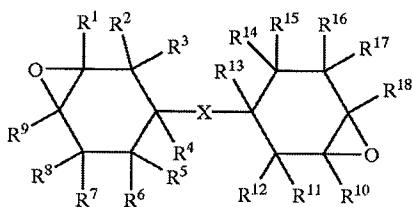
Further, in the present Example 2, the *concentration of high-molecular-weight components* is **3.7%**. In contrast, the *concentration of high-molecular-weight components* is **14.7%** in Comparative Example 2. The difference between Example 2 and Comparative Example 2 is whether the post-reaction solution was distilled in a WFE-type thin film evaporator at a heating temperature of 180°C and a pressure of 5 Torr or not.

Therefore, the composition having the reduced *concentration of high-molecular-weight components* being 5.5% or less is apparently obtained as the distillate of the purification by distillation of the post-reaction solution with a wiped film evaporator at a heating temperature ranging from 180 to 350°C and at a pressure of 1 to 50 Torr.

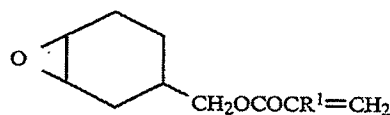
In view of the above, Applicants respectfully submit that the composition of Takai '618 does not implicitly have the properties of the present invention. Applicants now turn to the Examiner's reliance on an allegedly similar composition in Kuwana et al. '176 to disclose these features.

Regarding **Kuwana et al. '176**, the properties of the composition of Kuwana et al. '176 completely differ from that of the composition disclosed in Takai '618.

Takai '618 refers to a compound having two rings, but Kuwana et al. '176 refer to a compound having a single ring as shown below. These compounds differ from each other in structure and properties.



Takai '618



Kuwana et al. '176

Thus, these references are not properly combinable. The Examiner appears to be imparting the properties of the composition of Kuwana et al. '176 to a completely different composition disclosed in Takai '618. For this reason, a *prima facie* case of obviousness has not been established, and withdrawal of the outstanding rejection is respectfully requested.

Additionally, Kuwana et al. '176 disclose a process for the preparation of a purified 3,4-epoxycyclohexyl methyl (meth)acrylate, characterized in that a centrifugal extractor is used and retention time therethrough is adjusted within 5 minutes in extracting with water to remove the organic peracid and an organic acid derived from the organic peracid used in the epoxidation reaction (col. 5, lines 49-56).

Kuwana et al. '176 further disclose a process for the preparation of a purified 3,4-epoxycyclohexyl methyl(meth)acrylate, characterized in that a crude reaction solution having 3,4-epoxycyclohexyl methyl(meth)acrylate is processed by the steps of:

(a) extracting said organic peracid and an organic acid in the crude reaction solution derived from said organic peracid with water using a centrifugal extractor in which retention time therethrough is adjusted within 5 minutes in extracting with water to remove the organic peracid and an organic acid derived from the organic peracid.

(b) neutralizing said organic solution layer with an aqueous alkali solution to form an organic solution layer and an aqueous solution layer, and separating said organic solution layer from said aqueous solution layer, and successively

(c) evaporating said organic solution layer at temperatures not more than 100°C and at reduced pressures *to obtain* a 3,4-epoxycyclohexenyl methyl (meth)acrylate solution including low-boiling ingredients of from 3 to 50% by weight, and further

(d) evaporating said 3,4-epoxycyclohexenyl methyl (meth)acrylate solution at temperatures not more than 100°C and at less than 1/2 of the reduced pressures in the above-mentioned(c) *to obtain* a purified 3,4-epoxycyclohexenyl methyl (meth)acrylate including the low-boiling ingredients of not more than 1% by weight (col. 6, lines 1-30).

However, Kuwana et al. '176 do not disclose *the high-molecular-weight components having an elution time shorter than that of the alicyclic epoxy compound represented by the general formula (I) in detection by a gel permeation chromatography and the removal thereof.*

The high-molecular-weight components detected by a GPC analysis in the present invention include a polymerized material of the alicyclic epoxy compound (I), and the monoadduct or polyadduct of a carboxylic acid secondarily produced from an epoxidizing agent to the alicyclic epoxy compound (I) (page 18, lines 15-19) and **differ from** the organic peracid and an organic acid derived from the organic peracid as compounds to be removed in Kuwana et al. '176.

In the present invention, *the high-molecular-weight components detected by a GPC analysis* are removed by distilling the post-reaction solution with a wiped film evaporator at a heating temperature ranging from 180 to 350°C and at a pressure of 1 to 50 Torr to obtain the solution having 5.5% or less of *the high-molecular-weight components as the distillate.*

However, Kuwana et al. '176 do **not** disclose purification by distillation with a wiped film evaporator at a heating temperature ranging from 180 to 350°C and at a pressure of 1 to 50 Torr *to obtain* the high-purity alicyclic epoxy compound wherein the concentration of high-molecular-weight components having an elution time shorter than that of the alicyclic epoxy compound in detection by GPC analysis is 5.5% or less as the distillate.

To establish a *prima facie* case of obviousness of a claimed invention, all of the claim limitations must be disclosed by the cited references. As discussed above, Takai '618 in view of Kumabe et al. '070 and in further view of Kuwana et al. '176 fail to disclose all of the claim limitations of independent claim 1, and those claims dependent thereon. Accordingly, the combination of references does not render the present invention obvious. Furthermore, the cited references or the knowledge in the art provide no reason or rationale that would allow one of ordinary skill in the art to arrive at the present invention as claimed. Therefore, a *prima facie* case of obviousness has not been established, and withdrawal of the outstanding rejection is respectfully requested. Any contentions of the USPTO to the contrary must be reconsidered at present.

Obviousness-Type Double Patenting

1) The Examiner has provisionally rejected claim 7 under the doctrine of obviousness-type double patenting over claim 20 of co-pending Application No. 11/792,782.

2) The Examiner has also provisionally rejected claims 1-3 under the doctrine of obviousness-type double patenting over claim 5 of co-pending Application No. 10/883,162.

With respect to the first provisional rejection, the Examiner is respectfully requested to reconsider based on the amendments to claim 7. Regardless, the rejection is a provisional rejection with respect to a later-filed copending application. Thus, no action is required by Applicants at this time. See MPEP 804, page 800-17.

Regarding the second provisional rejection, claims 1-3 have been cancelled herein, which renders the rejection moot.

CONCLUSION

A full and complete response has been made to all issues as cited in the Office Action. Applicants have taken substantial steps in efforts to advance prosecution of the present application. Thus, Applicants respectfully request that a timely Notice of Allowance issue for the present case clearly indicating that each of claims 7-12 and 15 are allowed and patentable under the provisions of title 35 of the United States Code.

Should there be any outstanding matters that need to be resolved in the present application, the Examiner is respectfully requested to contact Chad M. Rink, Reg. No. 58,258 at the telephone number of the undersigned below, to conduct an interview in an effort to expedite prosecution in connection with the present application.

If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies to charge payment or credit any overpayment to Deposit Account No. 02-2448 for any additional fees required under 37 C.F.R. §§ 1.16 or 1.17; particularly, extension of time fees.

Dated: MAY 22 2009

Respectfully submitted,

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